TPRS

Quarterly Report

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President's Report

IN THIS ISSUE

President's Report
Tom McDermott, N5EG

Volunteers - a big thanks!

A lot of changes this time. First - I would like to thank four people who have extremely helpful in operating TPRS. First is Brad Smith - who has edited the TPRS Quarterly Report for 3 years. Brad was instrumental in setting up the slimmed-down page sizing (which cut our production costs in half), and automating the layout and article formatting. Brad left things in very good shape, so that taking over the production and layout of the QR was very easy to do. We're going to miss Brad's help and responsiveness in getting the QR printed on time each month for the last 12 isues.

Another big help has been Frank Aguilar - who took over the TPRS member database 3 years ago, and automated a lot of the functions, and cleaned up the formatting and label production. Frank also handled all the production of labels, and was able to e-mail a WORD file each quarter that was easy to run labels from. Frank also took care of updating the database with new member and renewing member submissions.

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TPRS Quarterly Report

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Thirdly - Dorothy Jones (the TAPR secretary) has been teriffically helpful in collecting TPRS mail at the PO Box in Denton, and sorting and delivering it within a day or two of arrival. In the 10+ years I've known Dorothy, she has become the friendly voice of packet radio for what I would guess is the majority of packet radio enthusiasts (through TPRS and later TAPR), and the personal interface for those who go to Dayton. Few people realize how much we all owe Dorothy, and how the smooth operation of TAPR depends on her.

Lastly - Jim Neely has been one of those wonderful people to work with. Jim has been our treasurer and accountant for TPRS since almost the inception of the organization. He's one of those guys who's very responsive, and you know when you ask him a question that you'll get the right answer, and get it quickly. Jim has also been a director of TAPR, so he's put a lot of time and effort into making the two organizations pretty good clubs. We always forget to mention how much work sometimes people really contribute to the organization.

There's lots of other people who make things work, 3-4 come to mind immediately, and we'll try to mention them in an upcomming issue of the QR. Most of the time it's the people you don't see that make such a lasting contribution.

Brad and Frank have both asked to give up their responsibilities - thanks guys, you really helped out!

ELECTION OF DIRECTORS

Speaking of volunteers, we have two openings for directors this year. On even years we elect two directors, and on odd years we elect three directors. The terms of Joe Borovetz and David Wolf expire this year, and if you have an interest in attending a pretty minimal set of meetings (one per year, curently), and being part of an email-list, we'd love to have you apply. Send your nominations to n5eg@tapr.org.

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HAMCOM 2000

Time to mark you calendars for the annual Hamcom conference in Arlington, Texas. This year it's being held on Friday, June 9, and Saturday, June 10th. You should have recieved your Hamcom newsletter by now - if not, check out the website: http://www.hamcom.org for registration info. Extra prize tickets go to those who pre-register by May 20th! The schedule for Hamcom this year is:

The Flea Market is open Friday Noon to 7:00 PM, and Saturday 7:00PM to 5:00 PM. The commercial exhibit area is open the same hours as the flea market (two hours earlier than before).

Maury Guzick has done a super enthusiastic job as chair of Hamcom in rallying the volunteers for this year. He's interjected a lot of good ideas into the program committee, and I'm sure you'll like the results.

TPRS and TAPR are again going to occupy two booths in the commercial exhibit area - so you'll have a wide array of things to see and do. Last year was the first time we pooled our resources, and the results were pretty good by all accounts.

Please stop by to say hello and chat about what you are doing.

TPRS Digital Programs at Hamcom

Of course TPRS will have a great program sequence again this year. Last year we had a condensed (4 hour) slot - but the programs were first rate, and the multimedia IP demo was super! This year we have 5 hours of programs, and they promise to be as good as last year.

Saturday, June 10, 2000

9:00 - 10:00 What's new in APRS - Guy Story, KC5GOI

The Automatic Position Reporting system (APRS) allows generating automatic position reports via amateur packet radio. In the last year a new public specification for APRS was produced, adding and documenting a large number of new features for APRS. These add a significant number of new capabilities to APRS, such as nation-wide short messages and pages, Internet-enabled group tracking, etc. Guy will discuss the basics of APRS, some of the new features, and how you can setup your own APRS station. Guy is an engineer specializing in RF emission and compliance testing.

10:00 - 11:00 Creating a Next-Generation Ham Radio Digital Network - Greg Jones, WD5IVD

Greg will discuss new technology that will enable the linking of a new generation of ham digital communication nodes. Particularly, VSAT (Very small-aperture Satellite Terminals) which depend on low-earth orbiting, or high-power synchronous satellites can allow interesting solutions to the problem of linking packet radio nodes over long distances. Greg will discuss where this technology is headed, and how it applies to amateur radio. Greg is president of the Tucson Amateur Packet Radio Society (TAPR).

11:00 - 11:30 Differential GPS - Bob Stricklin, N5BRG

Differential GPS is a technology that allows dramatic improvements in the positional accuracy of the Global Positioning System (GPS). Now, amateur radio operators can easily construct a differential GPS transmitting station using APRS to format and send the correction messages. Bob will discuss how to build your own low cost D-GPS station, and the kind of accuracy you can expect. Bob is a senior engineer and marketing manager specializing in optical and electrical component technology at Optek.

11:30 - 12:00 A 115,000 bit/second Transceiver in your Wrist Watch - Frank Perkins, WB5IPM

New RF transceiver technology now makes it possible to integrate a high-speed digital data radio

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into a single silicon integrated circuit. A new generation 115,000 bit per second transceiver that weighs only 0.3 grams (a copper penny weighs 3 grams) and would fit into Dick Tracy's wrist watch will be illustrated. Some applications for this compact, low-cost, RF transceiver technology will be discussed. Frank is Vice President of Marketing for RF Monolithics.

12:00 - 12:30 Lunch Break

12:30 - 1:00 Annual Business Meeting, Texas Packet Radio Society

1:00 - 2:00 Extremely High Performance Digital Filters using FPGAs - Tom McDermott, N5EG

Field-Programmable Gate Arrays (FPGA), and development tools for FPGAs have increased markedly in capability in the last 3 years. The tools now completely automate the generation of digital serial arithmetic generation, which allows rapid and simple generation of digital filters. As part of the TAPR Spread Spectrum radio project, a 400 Mega-FLOP (equivalent to 400 million floating point operations per second) digital filter design was generated, simulated, and implemented in a single programmable device in only 3 weeks. This program will show how you can design and implement filters that are beyond the reach of general purpose DSP chips. Tom is Vice President, Technology for Chiaro Networks.

Dayton 2000

Not to forget, the premier event in Ham Radio is also on tap this month, the Dayton Hamvention is Friday, May 19 through Sunday May 21. TAPR will have two booths at the show, and all the goodies you missed somehow (GPS receivers, MIC encoders, etc.) will be there. The TAPR newsletter should detail all the arrangements. With introducitons last year of some fully-integrated data-radios (i.e. talkies with built-in

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Texas Packet Radio Society, Inc.

TPRS was founded in 1985 and is an educational, public service, and scientific research non-profit corporation. Texas Packet Radio Society goals are:

1- design and research amateur radio packet networks
2- provide education in the area of general packet usage

To accomplish better communications in the region, TPRS has been organizing statewide working groups to cover various networking topics. The current working groups are the Mailbox/BBS Group, TCP/IP Group, and the TexNet Support Group. TPRS hopes that these working groups will help promote information exchange in their respected areas in Texas. New working groups are formed as needed to provide channels for discussion and to help provide direction for that area of digital communications. Anyone can participate in a working group; TPRS membership is not required.

TexNet

TPRS has established a digital packet network protocol, a standard hardware package for the network nodes, and software modules that implement the TexNet network.

The basic design philosophy of TexNet is an open, inexpensive, multi-resource, high speed 'backbone' with access through multi-connect capable local nodes. On the high speed side, TexNet is a 9600 baud network system. For local access, compatibility with the typical 2 meter AX.25, 1200 baud, AFSK/FM station is the operational norm. Other baud rates and modulation techniques can be supported on the primary user port or secondary port. The system is totally compatible with both versions of the AX.25 protocol specifications for user connections. With these general specifications, TexNet has been designed and tested to enable all users to take advantage of this high speed, full protocol protected packet network system.

Each node offers, in addition to TexNet access, local area digipeater service, 2 conference bridges for full protocol protected roundtable or net operation, a full mult-connect, multi-user mailbox system, a local console for installation and maintenance setups, a debugger module for long distance and local software monitoring,and an interface for a weather information server for regional weather information, if available.

The NCP-PC (TexNet for PC) creates a direct interface to the PC platform. The Z80 based PC card supports 4 channels for communications. This co-processor approach allows the AX.25 and TexNet-IP to run on the card without affecting the PC. This allows the full power of the PC to be used for network applications. The versatility of this board is only now being developed and applications are endless.

The TexNet Network

The Texas TexNet network system has been operational since October 1986. When fully operational, the network reaches from the border of Mexico to Missouri. Use of the Texas TexNet system is open to all amateur operators. TPRS has been coordinating the installation of the Texas TexNet system. Further expansion of the system depends entirely upon the amateur community.

INFORMATION

TPRS is interested in spreading our information and research efforts as widely as possible. We want other groups involved with packet efforts to get in contact with us. We will provide information for those amateur packet groups that are interested in this system for their areas. If you would like more information concerning TPRS or TexNet, please drop a letter to:

Texas Packet Radio Society, Inc.
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TPRS MEMBERSHIP

TPRS membership is widespread with most members located in Texas, but members are located in other states and in foreign countries. Membership is open to any interested person. If you are interested in becoming a member and receiving the TPRS Quaterly, please send your name, address and call with membership dues of $12 per year. A membership application is available elsewhere in this issue.

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APRS), the rumor is we will see even more knock-your-socks off product introducitons this year. Dayton is ***the*** place to be if you are a "first-kid-on-the-block-to-have-it" radio nerd. If you have never been to Dayton, you really owe it to yourself to go once. It's quite an experience!

Mailing Labels

In the last week, we converted our TPRS membership database over to Microsoft Access 97. Some people say that Access is a love/hate relationship. I felt both at the same time! A lot of manual re-keying of data was required to get all the fields into the right format, and fix conversion errors that have crept into the database over the last 10 years. The benefit is that most of the common database operations are now completely automated. We tried to exercise due care, but it seems like something always goes wrong in one of these conversions. Please look at your mailing label carefully and let me know if there is anything wrong with it — I'll check it out and let you know. The best way to reach TPRS for correction, questions, etc. is through the email address: n5eg@tapr.org

PSK31 - totally amazing software

Well, I gave in and decided to download and try out PSK31. It cost all of $0.00 for the software, and only a little more for the hardware. PSK31 is a phase-shift-keying mode that operates at a slow data rate, about 31.5 baud (hence the name). It's really optimized for keyboard-to-keyboard communications, and has the ability to dig stuff way out of the noise. The first software downloaded was the Windows PSK31 package from the offical website in Spain. This was pretty impressive - but needed the tuning skills of a surgeon (with really good eyeglasses to boot). It was fun for about one QSO, but the performance is truly impressive. Then I found DIGIPAN — ever have love at first site? This software is absolutely incredible. It provides a full panoramic walking spectrum display of the autio passband of your receiver. You can actually see multiple PSK31 signals simultaneuosly. You just use the mouse to center the pointy cursor over a sigal you are interested in, and 'click' the mouse - voila - the same signal is tuned in automatically, and the content deciphered and printed on the screen. You don't have to tune the radio! On transmit, the software automagically generates the precisely correct transmit tones to reply exactly on the same frequency as the received station. Holy zero-beat, Batman! (if I have to explain that, I'm way too old).

You can also see other signals (RTTY, PACTOR) in the spectrum analyzer display, but unfortunately cannot decode them. As you widen and narrow the passband of the receiver, you can see the noise change on the spectrum analyzer display. It's quite possible to see signals buried in the noise with the analyzer, select them with the mouse, and get perfect copy. Lots of apartment dwellers, trailer dwellers, etc. who have miserable antenna access have found the weak-signal performance of PKS31 to allow them to operate with 20-50 watts. No TVI, and you can actually have an HF QSO with an invisible antenna (well, it has to be a reasonable antenna). Try N1RCT's teriffic web site for the appropriate software links: http://www.megalink.net/~n1rct/

I did have to build an interface from a SONY laptop to the HF radio. It turned out to be as simple as two potentiometers to allow padding down the tranmsit and receive levels, and a resistor and transistor to key the rig (solid-state PTT).

Most stations on PSK31 over-modulate their transmitter. It doesn't buy you anyting except excessive bandwidth (which the spectrum analyzer allows you to easily see) and wastes power generate sidebands that aren't used by the receive software - but it does make your wattmeter kick up higher. Do yourself a favor, and attenuate the send-audio (using the potentiometer) until you see no ALC action on your transmit signal - save power and genrate less QRM without compromising your receive print at all.

You may have noticed that the February issue was about 2 months late being delivered - it seems like everything that could go wrong did. Including late

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submission of articles by yours, truly, new software which was not backwards compatible with the old software, and a few other glitches. We always have one glitch, but this time I caused 4 of them which really killed the deadline. Hopefully, we've completely recovered, and come up with some glitch removers to make a more efficient process to produce the QR.

Well, enough rambling this time - we will continue with the Wireless Linux series from last time. There's a lot of gold buried in these articles!

-30-

Wireless LAN resources for Linux

Jean Tourrilhes

This article is reprinted with the permission of the author. It is continued from part 1 in the February 2000 issue of the TPRS QR.

4 Driver parameters

A lot of users are confused when it comes to set **driver parameters**. Those parameters usually allow to specify the *base address* and *interrupt* of the hardware to avoid scanning, but also might be used for multi-device configuration or wireless specific parameters (see below).

As it is explained nowhere correctly, I disgress a bit and give you a few hints...

For driver compiled **staticaly in the kernel**, the parameters are passed on the kernel command line. The syntax is "ether=*irq,base,name*" where *base* is the base address, *irq* the interrupt and *name* the device logical name (ex : *eth0*). The kernel command line is passed by *lilo* (or *loadlin*) itself, so in fact it means that you add in /etc/lilo.conf a line which look like this :

append="reboot=warm ether=0,0,eth1 ether=10,0x3E0,eth2 ether=11,0x390,eth3"

For drivers compiled as **modules**, the parameter interface is much more flexible and each driver may be different, so you must look in the documentation. Basically, the driver define a set of parameters by their name and you may set for each keyword an array (one value for each instance of the hardware). The module configuration is usually done in /etc/conf.modules like this :

alias eth1 hp100
alias eth2 wavelan
options wavelan io=0x3E0,0x390 name=eth2,eth3 irq=10,11

For **pcmcia modules**, the configuration is done in the pcmcia scripts.

5 More parameters to configure

The most obvious difference with Ethernet is that there is **more parameters** to configure. In order to communicate, all nodes of the network must have those parameters configured the same. Some examples are : *frequency* or *hopping pattern*, *network id* or *domain*, *encryption key* (for security)...

Under *Windows*, the installation program usually opens a nice window and asks the user to enter these parameters, or sets them to a default value. Some drivers set those parameters in a permanent storage in the device (*EEprom*), so the Linux driver is able to reuse them. But, the current tendency is to scrap the EEprom and to use the Windows 95 *registry* to save those parameters instead. Of course, the Linux driver can't retrieve the parameters in those conditions.

The **Wireless Extensions** (see next section) has been designed to simplify the process of setting those parameters under Linux by providing an unified interface across drivers, but not all drivers support (yet) the Wireless Extensions...

In conclusion, you must read your documentation to know what parameters need to be set, what they are used for, and look the Linux driver documentation to know how to set them under Linux. See below for a suggested list of information sources.

It is usually quite a good idea to install the Wireless Lan first under some mainstream operating system with the official vendors driver and tools, to have a feeling of how the beast does work. You might also compare the performance before and

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after :-)

Once you've got all those new parameters set, your Wireless LAN should be up and running.

6 Where to get information about your Wireless LAN

- The official documentation that come with your product.
- Manufacturer web page and support.
- Linux driver source code, documentation (headers, man pages), maintainer.

7 Wireless LAN deployment

From the network administrator point of view, the main problem with Wireless LANs is that the **medium is shared**. If on a cable you know who is there, anybody and anything can use the radio band.

To try to separate everyone out there, most products define some *network identifier* (Network ID, Network Name or Domain, in 802.11 it is also called ESSID). This is a number or character string which is used to identify all the people wanting to be one the same **logical network**. Networks using different *network identifiers* still share the bandwidth, but are logically separate and don't interfere with each other.

This situation is not totally ideal, so that's why usually you have some **distinct channels** (or *frequencies*, or *hopping patterns*). People on distinct channels use different part of the bandwidth, so don't interfere at all. If you want to install multiple independent networks in the same area, this is the way to go.

The Wireless LAN has only a limited range, so you may reach only device within that range. This is usually why you should define some cells where everybody is in range. If you want those cells to communicate or a node to move across cells, you should install an **access point** in each of those and configure those with the same *network identifier* (and add an Ethernet segment between the access points).

On the other hand, some time you just want to quickly set up a network between a group of nodes and don't want to build an infrastructure. Most Wireless LANs offer **ad-hoc networking**, allowing you to just do that (apart from TCP configuration).

Some network administrators are also a bit scared by security problem over the medium. The only solution is to use **encryption**.

8 Point to point links (connecting different LANs by wireless)

Most Wireless LANs are designed to be used as a local area network, where all the nodes can see each other or can see the access point, and they are attached to other networks through a single access point (or not at all in ad-hoc mode).

Some people have asked me question on how to use Wireless LANs to connect different LANs together using wireless technology, usually those LANs are in **distant places** (across the street). Most of the time, you can't use a Wireless LAN because you don't have a fully connected topology (some node can't see each other, it's more a set of point to point links) and you may need to use *directional antennas* to overcome the distance.

I've never personally tried this, but I see 2 ways to achieve this.

The first solution is to use **Wireless Bridges**. Each Wireless Bridge is connected to one of the LAN section and redirect the traffic over the air to the correct destination. There is many products on the market, they are a bit expensive but very flexible, transparent and optimised for the task.

The second is to use normal Wireless LAN cards, and to plug them in a *router* (for example a Linux PC). I recommend to use a Wireless LAN supporting *RTS/CTS* if you have more than one link, and to set them in ad-hoc mode (no access point). Each LAN segment must have a different *IP subnet*, and the wireless link must have it's own subnet (it can be a private subnet). After much config-

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uration of the routing tables of your network, you should be able to get it working.

Some people using the Aironet Arlan cards for this kind of application have made a very nice **Arlan Wireless Routing Howto**, and I believe it can apply to most other Wireless LANs as well :

http://www.rage.net/wireless/wireless_howto.html

9 Performance

If the Wireless LANs give enough performance for most users and applications, usually the experienced user is a bit disappointed when doing some real benchmarks. This is because the Wireless LANs are slower to start with and on top of that uses less efficiently the available bandwidth.

Most Wireless LANs have a **signalling rate** around 1 or 2 Mb/s. The signalling rate is the speed the bits are send over the air (Ethernet is 10 Mb/s), but doesn't account of all the overhead of the protocols.

The Wireless LAN protocols have usually a higher overhead than their wired counterpart (like Ethernet) because of some technological limitations and to improve the reliability and the coverage of the Wireless LAN (optimisation trade-offs). On the other hand, Wireless LANs protocols are also usually less sensitive to high load (the throughput doesn't drop when you overload the network - which could happen more often).

Some protocols also adapt the signalling rate depending on the quality of the link (for example a 2 level modulation 2FSK/4FSK). When the link is clear and reception is strong, it will use the fastest rate, but when there start to be noise or the device is further away, it goes down to the more robust rate. The throughput that you will get will depend on that as well (for example the high speed might be only usable in line of sight).

10 Reliability

Most Wireless LANs protocols include mechanisms to improve the **reliability** of the packet transmissions to be at the same level or even better than Ethernet (*MAC level retransmissions* for example). Anyway, if you are using a protocol such as TCP (the default under Linux), you will be fully protected again any loss or corruption of data over the air. In other word, when you copy a file across the radio, it can't be corrupted (but it might fail).

11 Coverage

The **propagation** of radio transmissions is influenced by many factors. Walls and floors tend to decrease and reflect the signal, and background noise make it more difficult to extract. The channel quality vary quite a lot over the time (*fading*).

Depending on the quality of reception, the error rate will change (forcing packet retransmissions), or the system may switch to a more robust (and slower) mode (fragmentation or modulation), so the actual throughput will vary from good to nothing.

Because of the way radio transmission are affected by the environment, it is quite difficult to predict the comportment of the system and to define a range. You will have some good, fair and bad area/period, the closer you are the more likely you are to be in a good one.

12 Mobility

One of the main advantage of Wireless LANs is that they offer **mobility**. It mean that even when moving around, you retain your connection to the network.

Of course, this mobility is limited by the range of the Wireless LAN. To extend the range, you must cover the area with **access points**, which very often include **roaming** : you switch transparently to the closer access point which provide you a connection to the rest of the world and nodes out of range.

If you want to move across IP subnets, this is time to try **Mobile IP** :-)

(Continued next issue.)

TPRS Node Assigments
Official Publication: February, 2000
Subject to Corrections/Additions/Deletions.

X = ACTIVE/COMPLETED
T = ACTIVE/TEST
P = PENDING

Nr	Status	City/Town	Alias	Call	User Port	Remarks
3	X	Dallas	TEXNET	WR5C	145.05	PMS
2	T	Richardson	TESTBED	W9DDD	None	R&D
	T	Richardson	RICH	W9DDD	None	R&D
1	X	Murphy	MURPHY	N5EG	145.09	
5	P	Austin	NWS	Unkn	None	Weather PMS
6	P	New Braunfels	STXWX	N5IUT	145.05	Weather PMS
7	X	Boerne	BOERNE	N5VUO	145.01	
8	X	Geronimo	GERONMO	WB5NSN	145.07	PMS(AKA GERLNK)
9	X	Austin	AUSTIN	WA5LHS	145.07	
11	X	San Antonio	ALAMO	N0CCW	145.09/223.50	
12	X	San Antonio	SALAMO	WA2MCT	None	
13	X	Denton	DENTON	W5NGU	145.03	
14	P	Lubbock	LUBBOCK	KC5KQF	145.05	
15	P	Midland	MIDLAND	WB5RXA	145.05	
16	X	Greenville	GREENVL	K5GVL	145.07	
17	P	Midland	MAFDXC	WF5E	223.58	DXCluster port
19	X	Rockport	ROCPRT	N5JKH	144.99/446.1	
20	X	C. Christi	CORPUS	N5XCH	145.05	
21	X	Pettus	PETTUS	KA5BWL	147.56	
23	P	Lubbock	LBBDXC	KA5EJX		DXCLUSTER
24	X	Austin	AUSDXC	K5TR	144.99	
25	X	Austin	ARESTC	W5TQ	145.73	
26	X	Victoria	VCTRIA	W5DSC	145.01	
27	X	Alice	ALICE	K5DYY	145.07	
28	P	Amarillo	AMARILO	WD5ILA	145.05	
29	P	Abilene	ABILENE	WB5EKW	145.05	
34	X	San Antonio	SANTEX	WB5FNZ	223.58	
42	X	Kingsville	TAMUK	W5ZD	144.91	(aka KINGVL)
43	P	Bryan/CollStn	SBRAZOS	KF5LN	145.05/446.10	
44	P	Bryan/CollStn	NBRAZOS	KG5ZD	446.1	(See Nr 43)
45	P	Fannin County	FANNIN	WB5RDD	145.05	
46	X	Sherman	SHERMAN	WB5CVR	144.91	
47	P	South Dallas	SDALLAS	KF5RN	None	
48	X	Waco	WACO	WD5KAL	145.09	
49	X	Falfurrias	FALFUR	WB5FRO	None	
50	X	Mercedes	VALLEY	W5RGV	144.60	DXCluster port 2
51	X	San Isidro	ISIDRO	K5RAV	None	
52	X	Brownsville	BROWX	K5RAV		NWS node
73	X	Fort Worth	FTWORTH	N5AUX	144.99	
80	T	AOHTST	AUSTIN	WB5AOH	None	R&D AUSTIN
95	T	TNC95	AUSTIN	WB5AOH	None	R&D AUSTIN

TPRS Node Assigments
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(Continued)

(100-150) Reserved for TexLink Node Usage

Nr	Status	City/Town	Alias	Call	User Port	Remarks
105	X	Floresville	FLORES	WD5DOE	None	
109	X	Refugio	REFUGIO	WB5OLT	None	
118		Moody	MOODY	W5ZDN	440.1	

(151-249) Reserved for Non-Texas Node Usage
(150-159) Reserved for Louisiana

151	X	Lafayette LA	LFTDXC	N5SYF	145.01	
152	P	BatonRouge LA	BTRDXC	N5VWM		
153	X	Maxie LA	MAXIE	K5USL	145.01	
160	X	Ft Gibson OK	FTGIBSN	N5GIT	145.01	
161	X	Muskogee OK	MKOTST	WA5VMS	446.5 PMS	
162	X	Muskogee OK	MUSKOGE	W5EJK	145.09	
164	X	Lincoln AR	FAYETVL	K5VR	145.69	
165	X	Clayton OK	CLAYTON	W5CUQ	145.03	
166	X	Ft Smith AR	FTSMITH	W5ANR	144.91	
168	X	Tulsa OK	NWTULSA	W5IAS	145.03	Temp. Off Air
169	X	Tulsa OK	TULWX	N5WX	NWS WX Server	
172	X	Okemah OK	OKEMAH	WB5HLR	145.69	
173	X	Choctaw OK	CHOCTAW	K5CAR	145.69	
174	?	Prarie Grove AR	HOGEYE	K5FXB	None	
175	X	Garfield AR	GARFLD	WB2ROC	None	
176	X	Aurora Missouri	OARSMO	K0SQS	145.05	
177	X	Mt Magazine AR	MAGAZIN	KF5XB	144.95	
178	X	Russelville	RSLVL	WB5BHS	UNKN	
179	X	Little Rock AR	LROCK	WB5SQK	144.97	PORT 2 446.50(FUTURE)
209	T	Little Rock AR	LRTST	KA5SQK	TEST Node	

(250-255) Network Reserved

If you are a TexNet node opearator/owner and have a correction to make to the list, advise to N0CCW@K3WGF.#STX.TX.USA.NOAM, or leave a message for N0CCW on the NDALLAS PMS of TexNet.

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Be sure to visit the TPRS web page:
http://www.tprs.org
for the latest information on TPRS activities.

A current listing of Packet nodes, frequencies, and networks is located in the **North American Digital Systems Directory (NADSD) on-line at:**
http://www.tapr.org/directory/index.html

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